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Consultant

Ground Water & Environmental Resources Management
Geotechnical Services

No; FR/ 15 Date : 18.11.2024

REPORT ON

IMPORTANCE OXEL SPRING AND IMPACT OF ONGOING CONSTRUCTION ON THE SPRING.

SUMMARY

Oxel Spring of Siolim Village Bardez taluka Goa, is Located at Coordinates :**15°37'49.9"N 73°46'42.4"E** by the side of Siloim-Camurilim road on foot hill region and at the junction of lateritic formation with paddy field. It is a contact spring emerging at the contact of secondary laterite and clay .Elevation of spring is about 11m above Mean Sea Level (MSL). It is a perennial spring but discharge vary very wildly from monsoon to summer (very less flow during summer) Spring water is directed though a channel to irrigate paddy field. Oxel spring is one among several springs found around the hill, and one among hundreds of springs found in identical hydrogeological setup of the coastal areas of Goa., Besides springs there are ground water seepage zones . Water from seepage zones and springs are generally used to irrigate paddy.. Major recharge area/Catchment area of the Oxel spring is the hill slope behind the spring which is covered with healthy vegetation. Our lady of Sea church and a cemetery is located on core of the catchment area.

Yield /discharge of spring may not be affected due to on-going construction at of residential building in the vicinity of oxel spring as major recharge area is hill slope behind the spring.

Overflow of septic tank from the site if any cannot reach the spring due to its topographic position of spring and Septic tank of proposed siet..

Contaminants entering the ground, either from soak pit or from leakage of septic tank at the proposed location (30m from Spring) may contaminate Oxel spring to some extent due to local slope and strata condition of the area. Detailed study may be needed to prove this.

N. Soma Sundaram

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Geotechnical Services

No; FR/ 15 Date : 12.11.2024

REPORT

1.Introduction

In response to the request of the Mr. Milind Gavde the Executive Engineer, Works Division I Water Resources Department , Government of Goa ,hydrogeological analysis of the area around Oxel spring has been taken up as per terms of reference. "***Study impact of on-going construction on the Oxel spring if any and importance of the said spring.***"

2. Methoed of Study ;

Hydrogeological interpretation of satellite imagery with limited field check. Satellite imagery (Google image)interpretation was carried out with background knowledge on comprehensive understanding of Hydrogeological setup of the area by Mr.N.Somasundaram, Ex.Sr.Hydrogeologist Water Resources Department and .Filled check was carried out by his associate Mr.Pratik Shinde Msc Applied Geology (groundwater consultant) He has also conducted survey with PQWT instrument on 8th November 2024.Two profiles were taken, one along road just above the Oxel spring and another downstream of Oxel spring.

3.Defenition of Spring and Location of oxel Spring

Concentrated flow of ground water seepage on the ground surface is known as spring. Spring emerges out where topography cuts the groundwater table . If one could see aerial photographs and satellite imagery, it is evident that Coastal areas of Goa is bestowed with hundreds of springs. Most of the springs occurring at foot hill region at the junction of paddy fields .are contact springs One such spring named as Oxel spring is located by the side of Oxel Camurlim –Duler Road (North western side of Road) shown on the Google Image (Plate 1) is at coordinate:**15°37'49.9"N 73°46'42.4"E** .

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4. Geomorphology & Drainage around the Oxel Spring

It could be seen on the enclosed Google image February. 2024(plate 1 B) and Topographical map (2) that Siolim –Camurlim, Duler Road is trending SW-NE direction near the location of spring. There is a Flat toped ridge South Eastern side of the spring (Behind the spring) reaching to the Maximum elevation of 80m above Mean Sea level (MSL). From the top of ridge (Which is a Surface water divide) topography is sloping towards the Camurlim road where elevation is 15 m above MSL. Along the road topography is nearly flat at the foothill region. .Chapora creek/Rivers is bordering the area in the NW part. Paddy field is occurring between Chapora creek and foot hill region is a coastal Plain. There is elevation drop of 3 to 4m from foot hill region (road) and paddy field .Surface Runoff (overland flow) during rain is through monsoon drains from hill to Chapora River.

5. Geological formations around Oxel Spring.

Very healthy vegetation along hill slopes and foot hill area indicate that there is good soil cover and availability of moisture ,below soil cover moderately hard laterite followed by soft laterite and hard silt / clay. Covers the area.. Blue black rock (argillite) of Sanvordem formation is expected below laterite sequence.

Foot hill region is covered with detritus laterite (secondary laterite) to the average depth of 5m followed by clay and hard rock Argillite at deeper level.

Paddy filed area (coastal plain) is covered with top soil and silt and clay up to average depth of 18m or more and followed by Argillite rock.

6. Hydrogeological setup of the area around Oxel Spring

Copious annual rain fall of about 2500mm is the only source for groundwater recharge. Bulk of rainfall occurs during South West Monsoon between June and September.

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However there are rains during Pre-monsoon and Post monsoon periods.

Ground water recharge takes place in all the geomorphic units but major ground water recharge area is the hill slope behind the spring, Hill slope covered with healthy vegetation (Tree cover) and lateritic soil provide good opportunity for ground water recharge from copious rain. Ground water recharged in hill slope migrates towards Coastal Plain with paddy fields

Ground water occurs under Semi-confined condition in deeper aquifer associated with fractures and Joints in hard rock argillite. The aquifer is discontinuous. Ground water also water occurs under water table aquifer (shallow water zone) in laterite. Foot hill region is ground water discharge area where open well zone is potential for development. There are few open wells in this region. Yield of open wells in paddy field area is poor due to poor permeability of soil.

6.Hydrogeological Setup of the Oxel spring.

All along the foot hill region at the contact of paddy fields/coastal plains there are zones of ground water seepage and springs. The seepages are due to damming effect of paddy fields on water migrating from hill slopes. The hydraulic conductivity (permeability) is higher in secondary laterite occupying food hill region whereas paddy fields (Coastal plains) are having poor permeability strata. Ground water migrating from hill is unable to move through coastal plains, therefore emerges as ground water seepage zones. Concentrated flow of ground water on surface (springs) are occurring where topography is cutting ground water table besides damming on water table aquifer. Oxel spring is emerging at the contact of secondary laterite and underlining Clay at the junction of foot hill region with paddy fields.

From the interpretation of satellite imagery (Google image) and limited field check it is found that there are about 6 springs (Annex 1) and few seepage zones in the vicinity of Oxel spring. All along Kamurlim Road and around the hill there are several such springs.

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Colour coded images generated by PQWD instrument (plate3 and 4) indicates that migration of spring water/seepage is perpendicular to the road along the slope. There are 6 water migration zones in surveyed profile length f110m (L471) Oxel spring is migrating from the hill across road in a narrow width of about 7m to 10m .Profile L472 taken downstream of Oxel spring indicates that the area is devoid of water bearing strata. Approximate boundary of recharge area/Catchment area of Oxel spring is shown on the Plate 5

While in service, Hydrogeological interpretation of aerial photographs and satellite imagery coupled with field checks had revealed there are innumerable springs at the identicai Hydro-geomorphic set up in Goa State. Besides contact springs at foothill region there are high level springs and springs emerging from deeper aquifer .But so far deep seated mineral sings and hot springs are not identified.

Generally discharges of springs reduces considerably during summer and some of them dries up . Spring flowing throughout the year (Though the discharge is poor in summer) are called prenatal springs .Oxel spring is a perennial spring as it is marked on Survey of India Topographical map on 1;25000Scale. It is observed that spring water is channelled to paddy fields to support paddy cultivation. This spring has been improved by Water Resources Department and water is also used for drinking and bathing. Most of the springs are primarily used for irrigating paddy fields with or without storage,

Chemical quality of spring water in Goa is generally good for drinking, domestic and irrigation purposes. Average Ph values of some of the springs water tested by CGWB during systematic surveys indicates that it is the order 6.0 to 6.5.(alkaline). However bacteriological quality of spring water is site specific which changes with time depending on anthropogenic activities in the ground water recharge area .

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N. Sumatra Tems

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7. On-going activity in the Vicinity of Oxel Spring

As per the site plane made available (Plate 6) residential building consisting of 8 villas with swimming pools are coming up parallel to Oxel-Camurlim road on North Western side (foot hill region.). Only one septic tank and one soak pits are proposed near eastern boundary within the setback area.at a distance of 30m from Oxel spring.. Regional slope of the area is towards paddy field towards ; N-W .From Septick tank and soak pit area topography is also slopping towards N-E parallel to road. There is elevation difference of about 3m between project site and paddy filed (Sharp cut) The project site is covered with lateritic soil and detrital (secondary) laterite which has better permeability. The site was originally covered with Vegetation. Monsoon water was flowing to paddy field but the site plane does not show any proposed drainage system.

8.Impact of on-going project on Oxel Spring

Location of Oxel spring and approximate boundary of on-going project is shown ion the Google image Plate 7.Approximate property boundary is marked With white dots and a patch of elevated area in-between spring and project site is marked with white dots.

Overland flow of water / Over flowing of Septic tank if any would reach down stream of Oxel spring as it cannot cross barrier located before the the spring..

Construction of buildings at the proposed site may not reduce the flow of the spring as the recharge area is hill slope behind the Oxel spring.

However when contaminant enters the ground either from Soak or oeakage of Septic tank at propsed location (30 m away from Spring may likly to contaminate Oxel spring to some Extent.

N. Sundaram

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However detailed hydrogeological study aided with tracers may be required to prove the impact of underground discharge of contaminant from approved location of septic tank and soak pit. Tracer studies are time consuming and expensive. Therefore shifting of location of Septic tank and soak pits I towards other margin may be betnificial to resolve contamination of Spring.

9. Importance of Oxel spring

Springs similar to Oxel Spring (contact spring) at the Junction of foot hill regions of Hills and Plateaus with coastal plains are very common in coastal areas b of Goa. Oxel spring is one among hundreds of springs in Coastal areas of Goa state. It is perennial spring and it is seen that water is primarily used for paddy cultivation. It is reported that spring water is also being used for drinking and bathing.

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4.Somasundaram N., 1982: Report on water supply investigation to Naval Establishments in Goa.Unpublished creport of CGWB Cetral Region Nagpur.

5.Somasundaram N (2013) Evaluation of downstream consequences of Groundwater development At Verna Industrial Estate and water resources management. Unpublished report of Water Resources Department, Government of Goa.

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Annexure 1

Location of Springs and Survey details with PQWT

Coordinates of the Oxel Spring:**15°37'49.9"N 73°46'42.4"E**
Elevation: 11m above msl

Identified spring 2: **15°37'53.4"N 73°46'47.5"E**
Elevation: 10m above msl

Identified spring 3: **15°37'55.3"N 73°46'55.7"E**
Elevation: 14m above msl

Identified spring 4: **15°37'58.2"N 73°47'00.0"E**
Elevation: 7m above msl

Identified spring 5: **15°37'39.9"N 73°46'22.3"E**
Elevation: 15m above msl

Two profile readings were taken, one on the upstream site of the spring and the other on the downstream side of the spring.

Profiles on the upstream side of the spring:
L471 - along ENE-WSW direction (profile taken from ENE to WSW), profile length 115m with 10m electrode equidistance and 5m shift. The spring is between the **2nd Node** and the **3rd Node**.

Profiles on the downstream side of the spring:
L472 - along E-W direction (profile taken from E to W direction), profile length 10m with 5m electrode equidistance and 0.5m shift.

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OXEL SPRING SIOLIM
Write a description for your map.
OXEL SPRING ON GOOGLE IMAGE
Plate 1
Legend
Our Lady of the Sea Church
Oxel Spring
Oxel Spring
Our Lady of the Sea Church
Google Earth
ge © 2024 Airbus
50 m
N

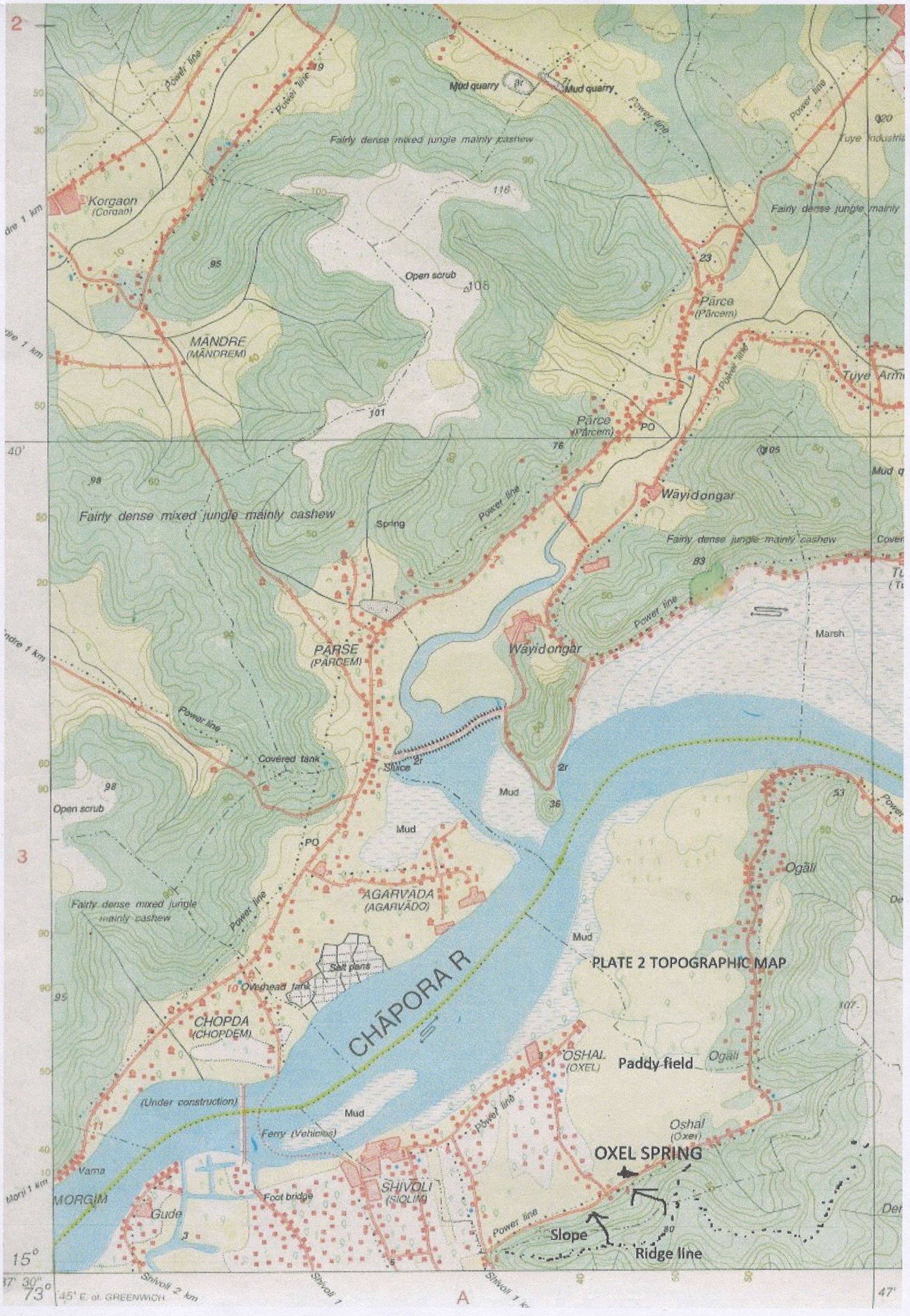
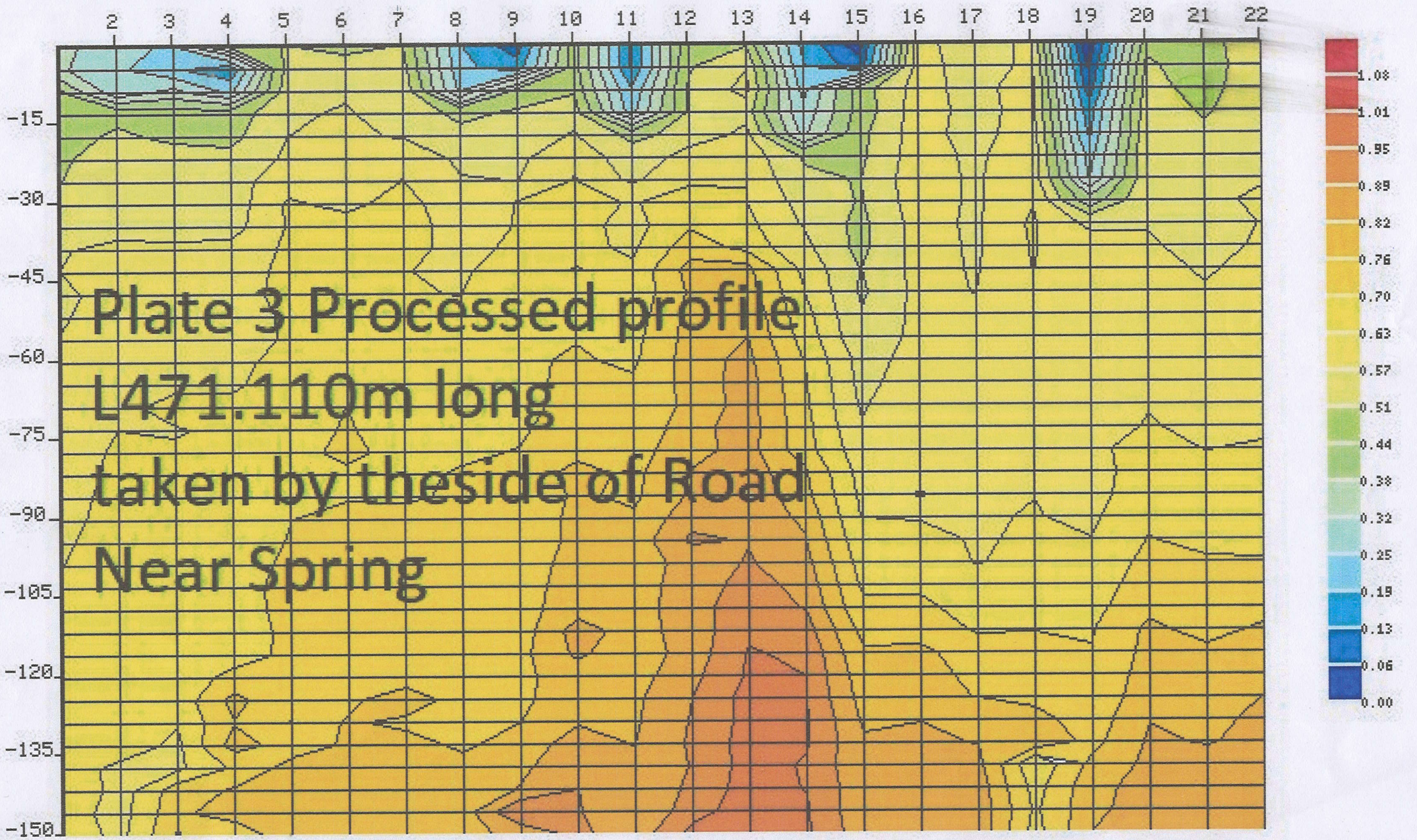


PLATE 2 TOPOGRAPHIC MAP
OXEL SPRING
Slope
Ridge line
Paddy field
CHĀPORA R
Korgaon
(Corgao)
MĀNDRE
(MĀNDREM)
Pārce
(Pārcem)
Wāyidongar
PĀRSE
(PĀRCEM)
AGARVĀDA
(AGARVĀDO)
CHOPDA
(CHOPDEM)
OSHAL
(OXEL)
SHIVOLI
(SIOLIM)
MORGIM
Gude
Ogāli
Fairly dense mixed jungle mainly cashew
Fairly dense jungle mainly cashew
Open scrub
Covered tank
Overhead tank
Salt pans
Ferry (Vehicles)
Foot bridge
Mud quarry
Power line
Marsh
Mud
Spring
Shivoli 2 km
Shivoli 1 km
45' E. of GREENWICH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-15
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-60
-75
-90
-105
-120
-135
-150
1.08
1.01
0.95
0.89
0.82
0.76
0.70
0.63
0.57
0.51
0.44
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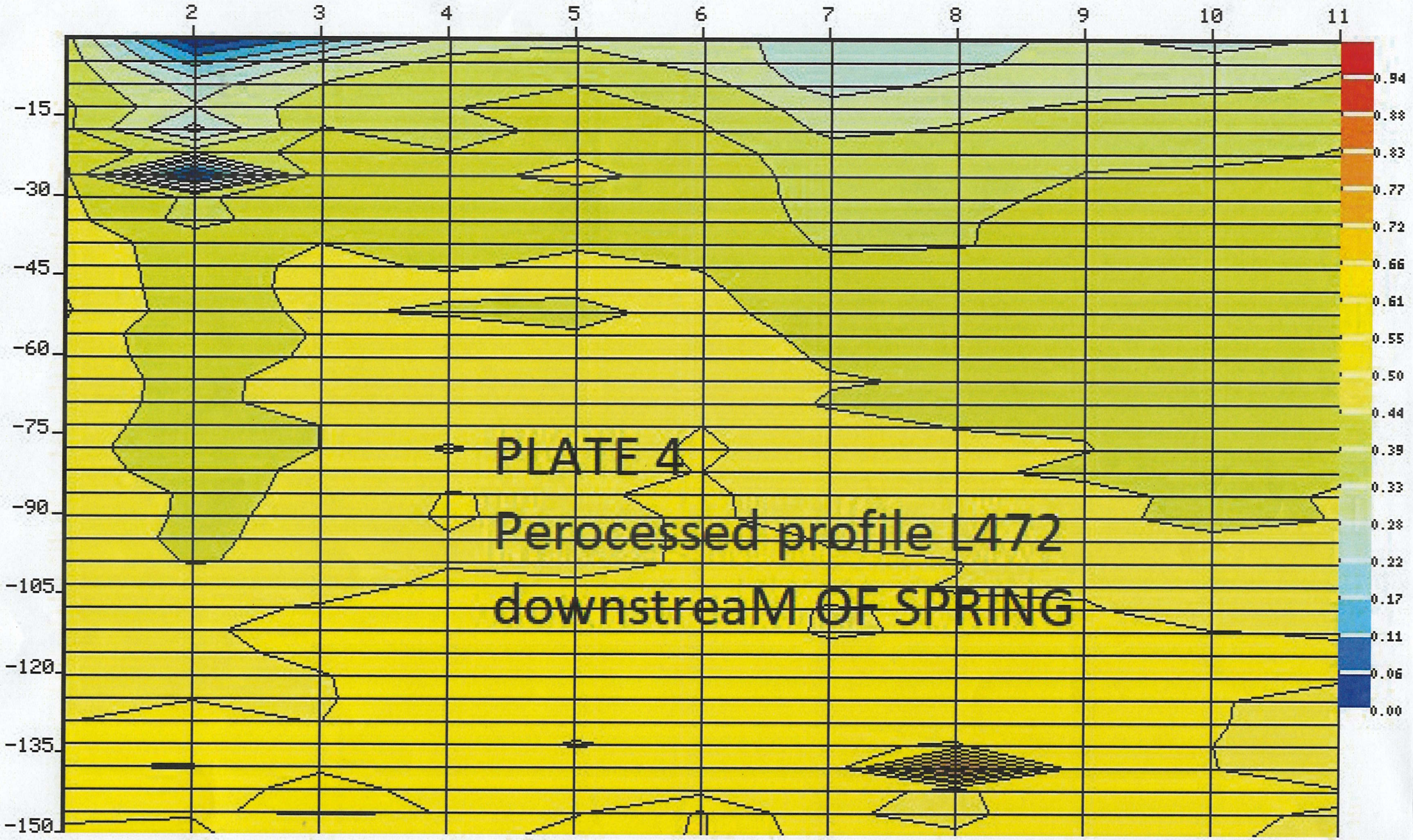
Plate 3 Processed profile
L471.110m long
taken by theside of Road
Near Spring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-150
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0.88
0.83
0.77
0.72
0.66
0.61
0.55
0.50
0.44
0.39
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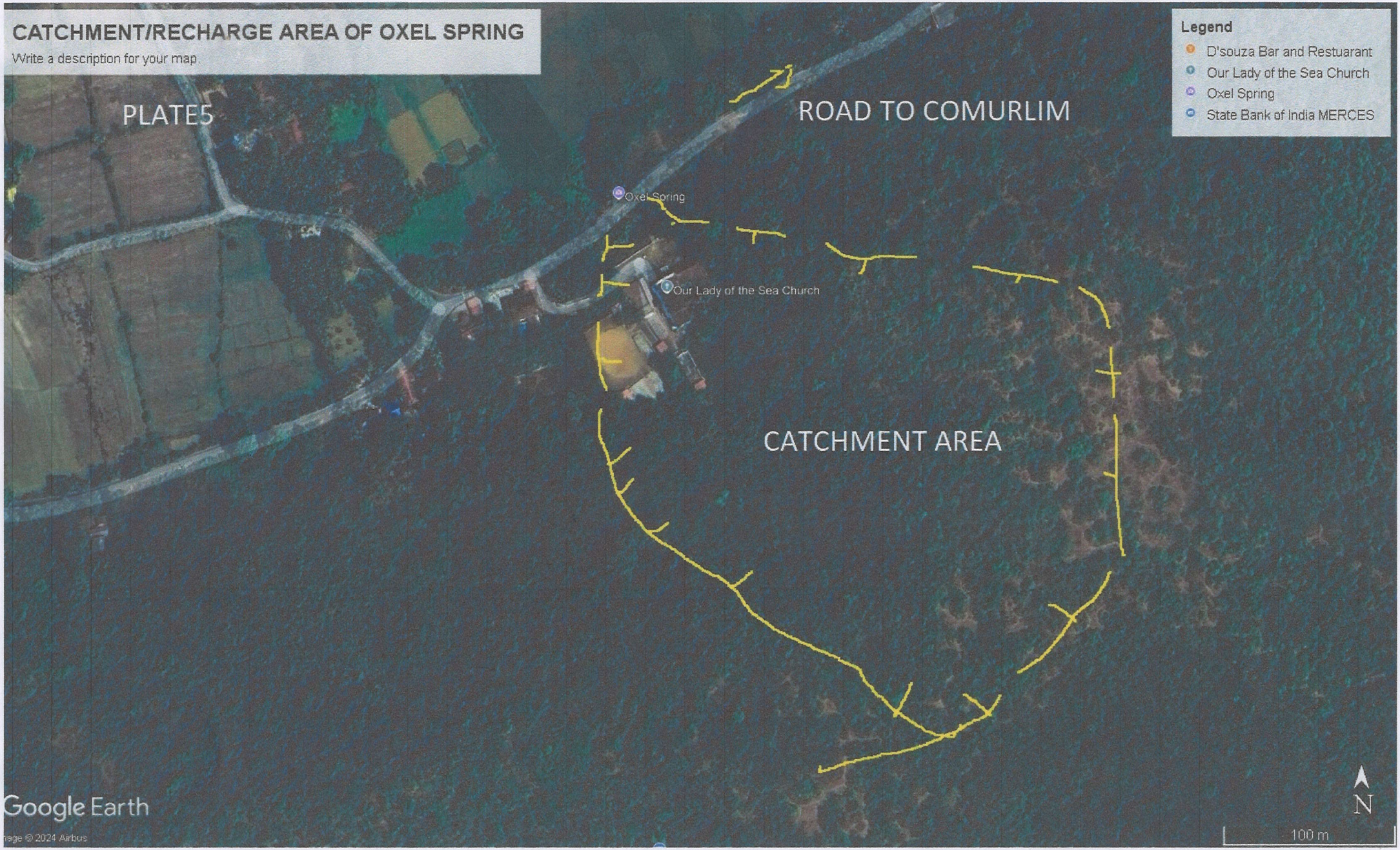
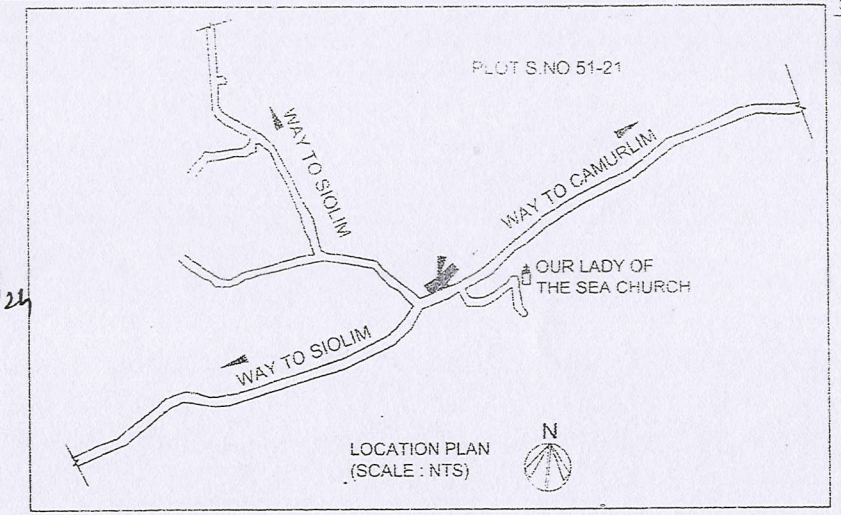
PLATE 4
Perocessed profile L472
downstreaM OF SPRING


CATCHMENT/RECHARGE AREA OF OXEL SPRING
Write a description for your map
PLATE5
ROAD TO COMURLIM
Oxel Spring
Our Lady of the Sea Church
CATCHMENT AREA
Legend
D'souza Bar and Restuarant
Our Lady of the Sea Church
Oxel Spring
State Bank of India MERCES
Google Earth
N
100 m

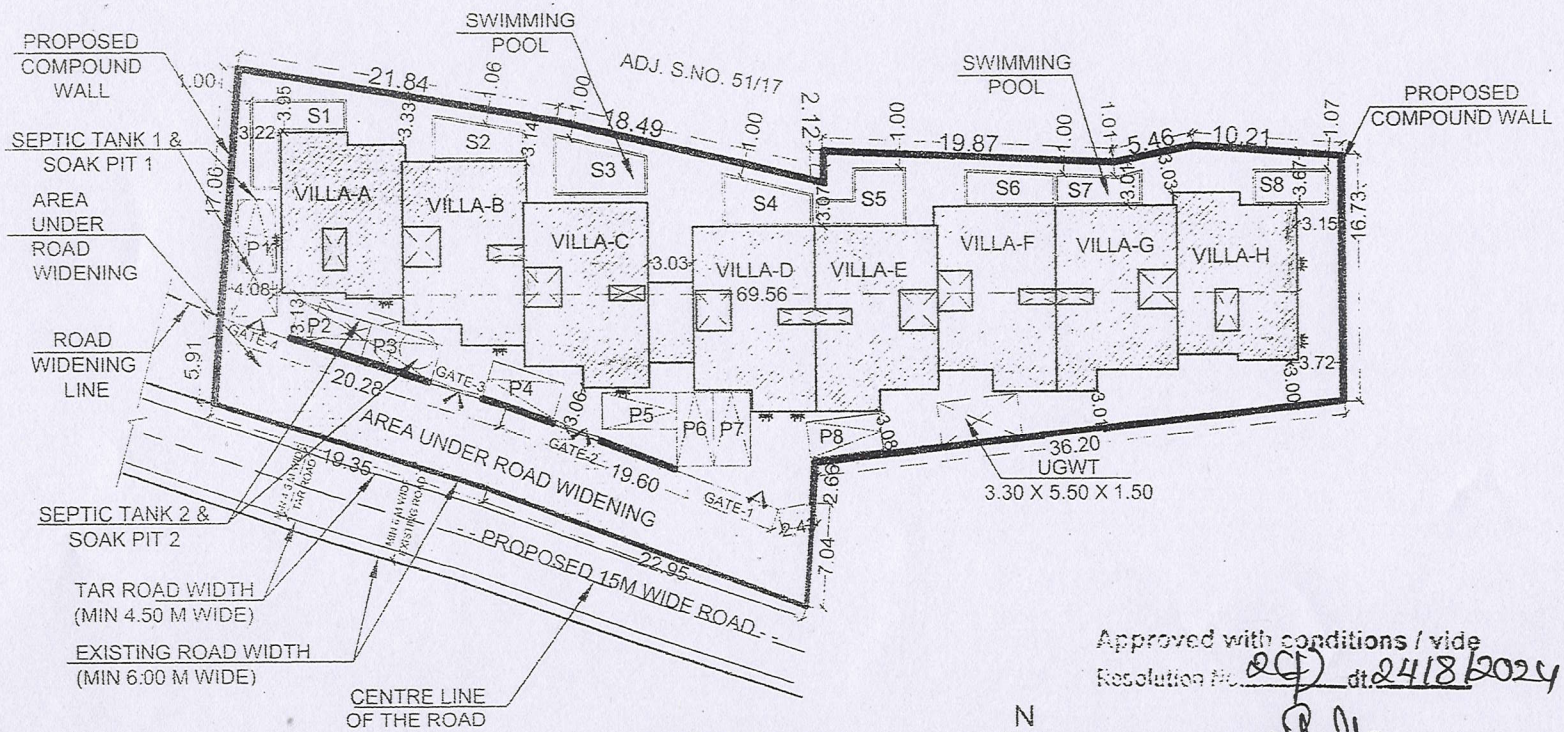
SHEET TITLE

REVISED SITE PLAN & LOCATION PLAN 01



Approved With Condition Vide
L. No: TPB/9241/OXEL/TP/24/5347
dt. 27/06/24

27/6/2024
Dy. Town Planner
Town & Country Planning Dept
Govt. of. Goa. Mapusa



SITE PLAN
(SCALE 1:500)

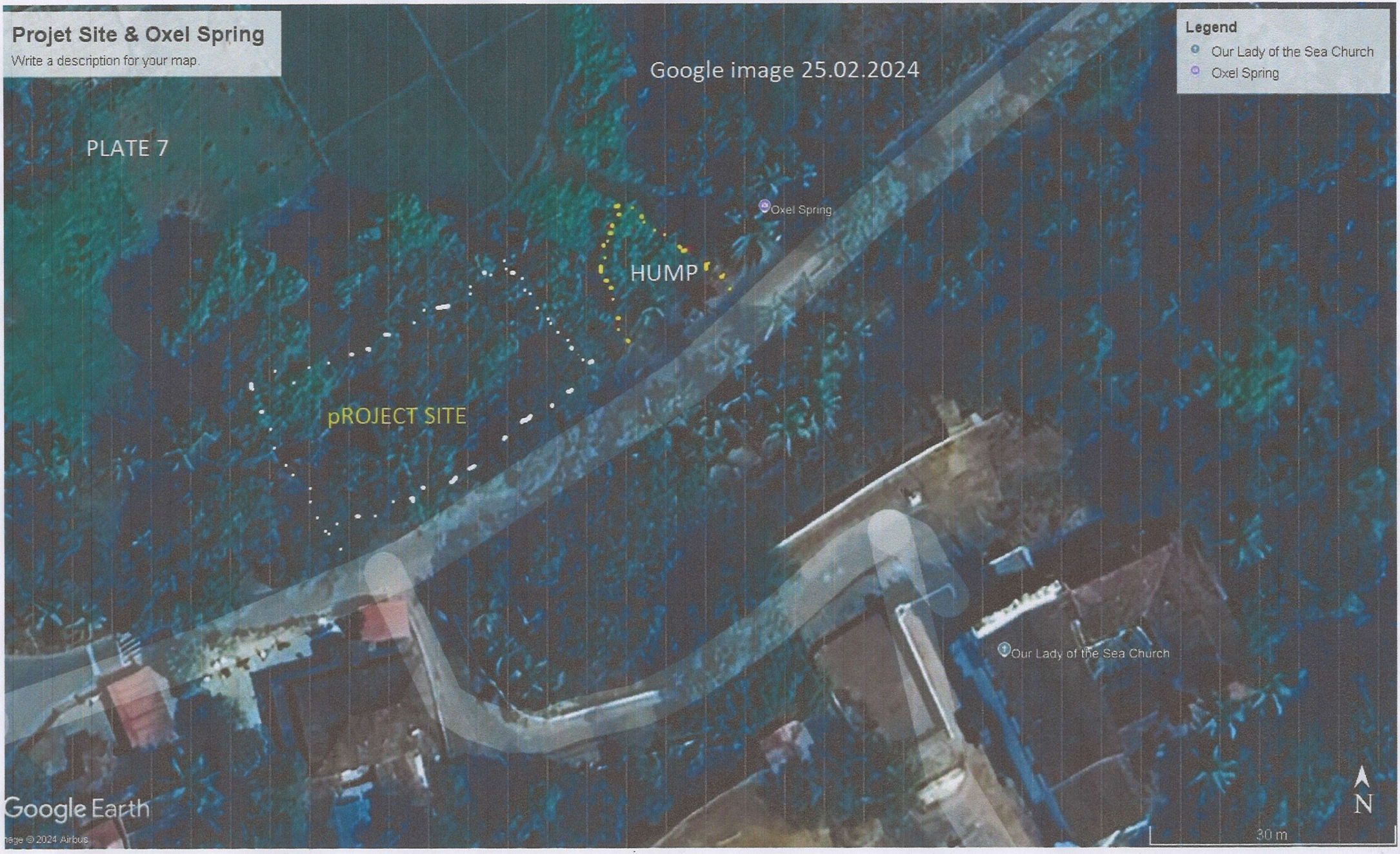
Approved with conditions / vide
Resolution No. 24 dt. 24/8/2024

Secretary
Village Panchayat Oxel
Bardez - Goa

DESCRIPTION OF PROPOSAL	
PROPERTY BEARING SURVEY NO 51/21 AT OXEL VILLAGE, BARDEZ TALUKA	
NAME OF OWNER	OWNER'S SIGN
1) Rora Export Private Limited. 2) Virti Sahni. 3) Jai Santushti Housing Private Limited. Address: Goa	
ARCHITECT'S NAME	ARCHITECT'S SIGN
Ar. JISHUTI POTEDAR CA/2008/3/083 FINCH ARCHITECTS	

NORTH

FINCH ARCHITECTS AND PLANNERS.
ARCHITECTURE & PROJECT MANAGEMENT
PUNE/GOA


Projet Site & Oxel Spring
Write a description for your map.
Google image 25.02.2024
Legend
Our Lady of the Sea Church
Oxel Spring
PLATE 7
Oxel Spring
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pROJECT SITE
Our Lady of the Sea Church
Google Earth
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30 m